Epoxy Resins

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Kirk-Othmer Encyclopedia of Chemical Technology

DOI: 10.1002/0471238961.0516152407011414.a01
Article Online Posting Date: December 4, 2000.

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Abstract

Epoxy resins are characterized by the presence of a three-membered cyclic ether group commonly referred to as an epoxy group, 1,2-epoxide, or oxirane. The most widely used epoxy resins are diglycidyl ethers of bisphenol A derived from bisphenol A and epichlorohydrin. The outstanding performance characteristics of the resins are conveyed by the bisphenol A moiety (toughness, rigidity, and elevated temperature performance), the ether linkages (chemical resistance), and the hydroxyl and epoxy groups (adhesive agents). In addition to bisphenol A, other starting materials such as aliphatic glycols and both phenol and *o*-cresol novolaks are used to produce specialty resins. Epoxy resins may also include compounds based on aromatic amine, triazine, and cycloaliphatic backbones.

A variety of reagents have been described for converting the liquid and solid epoxy resins to the cured state, which is necessary for the development of the inherent properties of the resins. The curing agents or hardeners are categorized as either catalytic or coreactive. Catalytic curing agents initiate resin homopolymerization, either cationic or anionic, as a consequence of using a Lewis acid or base in the curing process. Coreactive curing agents are polyfunctional reagents that are employed in stoichiometric quantities with epoxy resins and possess active hydrogen atoms. The important classes include polyamines, polyamides (formed from polyamines and dimerized fatty acid), polyphenols, polymeric thiols, polycarboxylic acids, and anhydrides.

The largest single use of epoxy resins is in the protective coatings market where high chemical resistance and adhesion is important. Epoxies have gained wide acceptance in protective coatings and electrical and structural applications because of their exceptional combination of properties such as toughness, adhesion, chemical resistance, and superior electrical properties.

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